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Art in the Science Classroom: Art Integration

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Abstract

The arts should be included in the science classroom as a way of helping students learn. Art integration provides a deeper understanding of the material to students and also gives students the chance to be creative in their school work. Over the next year, I intend to conduct research about the integration of art in a science classroom.

Introduction:

According to David Booth, in his article *Implementing an Arts-based Curriculum* (p. 9), art is important for children to learn. This concept is well known by both teachers[IT1] and parents, and additionally, through our own memories of childhood. From my personal experience of middle school education (grades 4-9), there is little art integration in the science classroom to help students better understand the ideas they are learning. However, if we consider the advice of David Booth, we can see how it is important for instructors to include the arts in our general curriculum. In the article, he stated art helps students have a deeper and better understanding of the curriculum students are learning (p. 10). In an article written by Shosh Brenner entitled, *The Theory of Multiple Intelligences*, we are reminded of different manners of intelligences [IT2] students possess (p. 16). This is not a new or novel perception, but one that has not been utilized fully in the classroom environment. For example, visual and kinesthetic learners would receive great benefit from integrating the arts into their classes. Barbara Soren compiled relevant information in her article entitled, *Research and Resources in Arts Education* (p. 138). In this article, Soren mentions a group of studies completed in 1999, which found the arts have a great impact on learning. These studies showed the arts are able to reach students and teach material not typically easily understood, transforms the learning environment for students, provides different challenges for those students who need them, and makes connections to real world applications.

The arts are described as dance, drama, music, visual arts, and literature in *The Creative Arts*, by Linda Carol Edwards (p. 11). Dance is “body awareness, fundamentals of movement, creative expression, and multisensory integration”; drama is “creative dramatics, pantomime,

improvisation, characterization, and play production"; music is "sound, pitch, rhythm, singing, playing, musical games, listening, and creative movement"; visual arts are "self-expression, visual and tactile art, print and craft media, analysis, and interpretation"; and literature is "poetry, illustrations, writing, award-winning books, storytelling, reading, and speaking" (p. 11). With so many different forms of art to choose from, inclusion in the science classroom should be relatively accomplishable for most topics.

Referencing the previous sources, I feel this is an important topic to research because art integration is something not done often, or consistently, enough in many schools, and, according to research, clearly poses benefits for nearly every student.

Literature Review:

A plethora of research has been conducted involving the topic of art integration/arts-based lessons. Through my studies, I discovered a number of articles about the integration of art into content-based classrooms.

Initial integration of art into lessons may be time-consuming. In an article by Masayuki Hachiya, *Finding Yourself in the Painting, Visual Arts Education* (p. 21-22), it is stated that students need to have enough time to finish their visual art work in order to develop their ideas fully and work with new materials. However, the article revealed students quickly learn to interact with other students regarding their artwork, perspectives, and experiences, thus fostering collaboration. The teacher can help students make connections between the artwork accomplished and the content in the lesson, as well as prompt students with hints to discover associations on their own. Making links between what you created and what you are learning is

an important factor in an arts-based lesson. This is essential because it promotes student evaluation in what they have accomplished and helps them to really understand why they are doing it as well.

When art is created, the artist uses the body and mind. Artists use their body as a mode of expression and their mind as the "integrative and imaginative force that makes expression meaningful" (p. 114). When we experience art as artists, we explore what we are doing and thus, make the artwork our form of inquiry.

The National Science Teachers Association (NSTA) references the National Science Education Standards in their position statement about scientific inquiry. In short, their position states scientific inquiry is a method used to help students develop and understand scientific ideas on their own and understand how to study the natural world. Inquiry-based learning is used in the science classroom as a method of learning (NSTA). Using the arts as a method of inquiry is a great way to allow for better student understanding of science topics. When students are asked to create a project, they are more easily able to understand conceptually, rather than to simply sitting and listening to a lecture (p. 115). In the article, *Research and Resources in Arts Education*, Soren found research stating 90% of parents said their students were more inspired to learn when the class was using art in its curriculum (p. 141). Furthermore, once students understand what they are learning, they are more likely to be motivated to complete the work. Art is a way that the material can be understood by most students, if not all students.

In the science classroom, there are many ways you can integrate all kinds of art. To give some reference about how art can be used in a science lesson to help students have better understanding, I consulted the book, *Lively Learning, Using the Arts to Teach the K-8*

Curriculum. The author, Linda Crawford, describes lessons a teacher, Lisa Boland from Valley Crossing Community School, completed with her science class utilizing movement as the art form to teach students content. Through the lesson, Boland taught her students vocabulary words relating to bodies of water and its movement.

First, she had them listen to water music and then she asked students to provide words describing what they heard in the music. After this, she introduced them to her vocabulary words relating to water, such as headwaters, mouth, source, delta, floodwaters, and tributary to name a few. Then students drew a river, labeled all the necessary parts, and the direction of the water flow. Once the students completed the drawing activity, they used their bodies to demonstrate what they had just learned. Students did some warm-ups first, then their teacher called out some of the words the students had thought of after listening to the water music.

Next, Boland put the students in pairs and had them use an atlas to draw a river in China onto a blank map of China. Some students then traced out the path of the river on foot, beginning where the mouth of the river was located, while other students used their atlases to guide walkers in the correct direction. Finally, students compiled all they accomplished that day and made a dance. Crawford quotes Boland as telling the students to "Make a shape with your bodies at the source of the river" and "Now move along the route showing three water words and then end with another shape" (p. 133). After the students had time to practice with their partner, they performed their dance in front of peers who applauded upon the completion of the performance. As students presented, their peers guessed what action the water was performing at the time the students chose to impersonate. Crawford ended the section stating this was a complex lesson that

Boland put together, but students would also benefit from simpler lessons, such as using movement to teach only the vocabulary used in this lesson.

As another example of art utilized in a science class, Crawford used visual arts to improve her fifth and sixth grade science classes' observational skills. Crawford took the students outside to look at a tree growing near the school. Crawford gave specific instructions to her students:

> Look at this tree carefully. Notice its size, structure, and the details of its leaf shape and arrangement on the branches. We're going inside in a few minutes to draw the tree, so use this time to print its image into your memory so you'll have what you need to draw it accurately (p. 137).

Once the students returned to the classroom, they had a hard time drawing what they observed outside so their teacher took them back out to look at the tree again. When they were outside for the second time, the text noted students were much more focused on the tree and details surrounding it. Crawford decided to have students use clipboards and finish their drawing outside, so they could examine the tree as they drew it. Crawford stated her students were happy with their final drawings and she knew the two attempts at drawing from memory enhanced students' observational skills of detail and ability to accurately record those observations. This case depicted art used as a tool to help teach key science skills as a natural extension of artistic ability. In order to be a skilled drawer, the artist must first pay attention to detail in their observations. This skill is one used in both art and science consistently, thus making it a natural fit to use art to help enforce the skill of detailed observations.

Both of these examples from Lisa Crawford's book, *Lively Learning, Using the Arts to Teach the K-8 Curriculum*, demonstrate how the arts were used in science classrooms to help students understand and learn the material better. In both of these lessons, the students were able to be creative in their learning and understanding of the material. Although there were rules about the finished projects, the students were able to be creative because there were fewer guidelines about how they should complete the project.

Barbara Soren quoted Terry Marks-Tarlow as saying creativity "thrives in the soil where two or more intelligences mix" (p. 145). This quote means that, for example, if you were to mix logical intelligences with visual and kinesthetic intelligences, the imagination of students would be grander than if you were to not mix these learning styles. Imagination is needed in our ever expanding world. To help with the growing need for creativity in our quickly evolving environment, many teachers and policymakers are relying on STEAM education (p. 21). STEAM is defined as Science, Technology, Engineering, **Art**, and Math while STEM is defined as Science, Technology, Engineering, and Math.

Dr. Helen Soulé stated in her article, *Why STEAM is Great Policy for the Future of Education*, that people are interested in promoting student involvement with hands-on learning experiences to foster critical thought, and also allow for the application of knowledge and learned content in a way meaningful for them. Soulé also states, not every child needs to grow up and be a scientist, designer, or engineer, but society needs all students to grow up thinking like one. Soulé believes with the help of STEAM education, instructors will be able to make this a reality for all students. Using STEAM education as a way to plan arts-based lessons allows for

the creativity of students, which builds their ability to be creative outside of the classroom and thus, prepares them for future jobs requiring inventiveness.

In all, there are multiple reasons why we should incorporate art into our science classrooms. Vidcode, a video-based coding platform, authored an article written for *The Huffington Post* concluding an art education allowed students to learn in a more open manner that made what they were learning relatable to real life. They pointed out art is used in a multitude of technology and other types of careers, an example of this would be a computer science major using art to help design something in the program they are coding (The Importance of STEAM Learning). It is vital we use art in our STEM teaching.

Methodology:

In an article by Masayuki Hachiya, titled, *Finding Yourself in the Painting, Visual Arts Education*, he presented an outline of what a proper art lesson should look like. The lesson should include; objectives for all art classes, materials and tools, and assessment of visual language into words. The objectives should be the project students will make and what they will learn from making the piece. Materials and tools are very important in art lessons as they are used to create the artwork, the imagination of students can be engaged with those materials, thus promoting student creativity in the process. Due to different levels of readiness, it is important to note how individual students are doing, and to assess what students created and learned while completing the artwork.

In the book, *Bridging the Curriculum Through Art, Interdisciplinary Connections,* it reported, “Art-based, integrated units of study are far-reaching, comprehensive, inclusive, and

intellectually challenging" (p. 11). Art-based units integrated with other curriculum, present students with lessons better suited for all students to learn to the best of their ability. This book noted the components of an art-based integrated unit as, "identification of a theme, identification of artworks, identification of objectives for each lesson, development of lessons, alignment of objectives and assessment within each lesson, and alignment of content standards between and among subject areas" (p. 13). Outlined are the guidelines that should be used for writing an art-based unit.

The first step is to identify your key concept (theme) or enduring ideas you want your students to learn, then you will need to find artwork pertaining to your theme. This step can be done in the reverse as well, if that fits the lesson better, meaning you can find the art then create the thematic idea. The second step is identifying objectives for your students. Stephens and Walkup stated you should ask yourself two questions when writing your objectives, "1. What is it that you really want students to know? and 2. How will you know that students have learned what you intended?" (p. 14). The third step is to make sure your objectives and assessments line up. The fourth step is to write the lesson. And the fifth step is to make sure your content standards are aligned with what you are teaching.

Following this guide there is a checklist for art-based interdisciplinary units of study. This

checklist asks you to make sure your lesson has the following:

- a clearly stated theme tying all parts of the unit together
- objectives that are precise and measurable
- potential artwork found for each part of the unit

- resources have been located
- a materials section for each lesson
- assessments lined up with objectives
- each part of the unit links to another and supports the exploration of the artwork
- students make art in part of the unit
- art critique completed in one part of the lesson
- aesthetics covered in one part of the unit
- art history depicted in another part of the lesson
- connections to different contents are made and have meaning
- content standards are used in the lesson
- each part of the unit flows from one to the other (p. 18)

The difference between an art lesson and an art-based lesson is the art-based lesson not only teaches art, but also is trying to teach another content area, such as science concepts.

In my research, I produced lessons using the outline described above. In order to see if the artwork actually helped my students understand the science topics better, I used a control group. The control group for my study was a group of students who did not have the art-based lesson, but a lesson more traditionally taught.

There are two fifth grade science teachers and classes in total at the school where I conducted my research. I used the other fifth grade class as my control since they are from the same school district, same age, same class size, and same lesson content. As the other fifth grade class is similar to mine, I was able to minimize and probably mitigate issues concerning control and experimental groups composed of different students. I had my students take a pre-assessment

to see what each child knew and how the class was doing as a whole to reduce the influence of differential learning and knowledge base upon my experimental design. The control class and the experimental class took the same test at the end of the unit.

I utilized my art-based lesson to teach my students the content required. I conducted my research during our ecosystem unit. At the same time, I had the other fifth grade student-teacher use an identical lesson, minus the art integration. Through this design, I formulated the methods of teaching as close as possible so the only probable dissimilar variable was the art integration within the science lesson. After the units were completed, each class was asked to produce a project as a summative assessment to provide a basis for my findings. The difference in scores from my class and the control group were the results.

My students were given a final project as their art integration. For the art integration of this project, students had to write a creative piece about the food chain they pulled from their food web (the food chain was one that could be found within the food web they had chosen) and then they needed to draw or create an electronic representation of the food web and chain. Students were given an outline of what they needed to do for the project and a rubric for them to follow.

Data and Analysis

The experimental group of students with the art integration lesson had 38 students who took the non-modified test and the control group of students without the art integration also had 38 students who took the non-modified test, this is a test for the regular education students . The test consisted of 41 points. On the test were a range of multiple choice questions, in difficulty and topic. Of all the questions on the test, only one was missed by more than 50% of students.

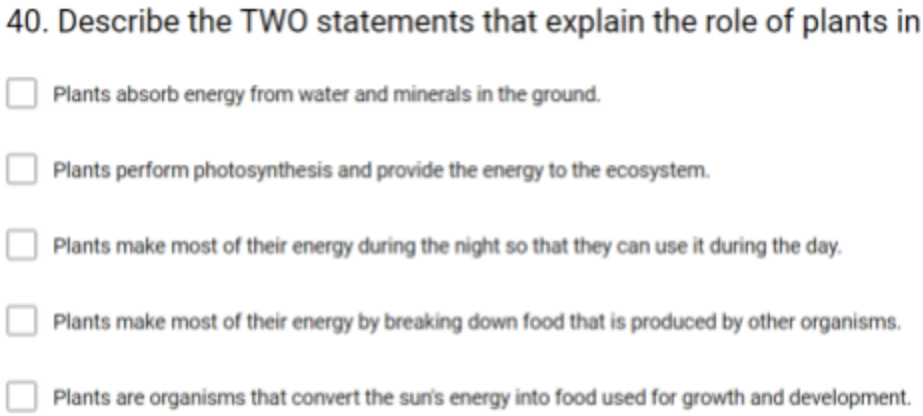

Figure 1

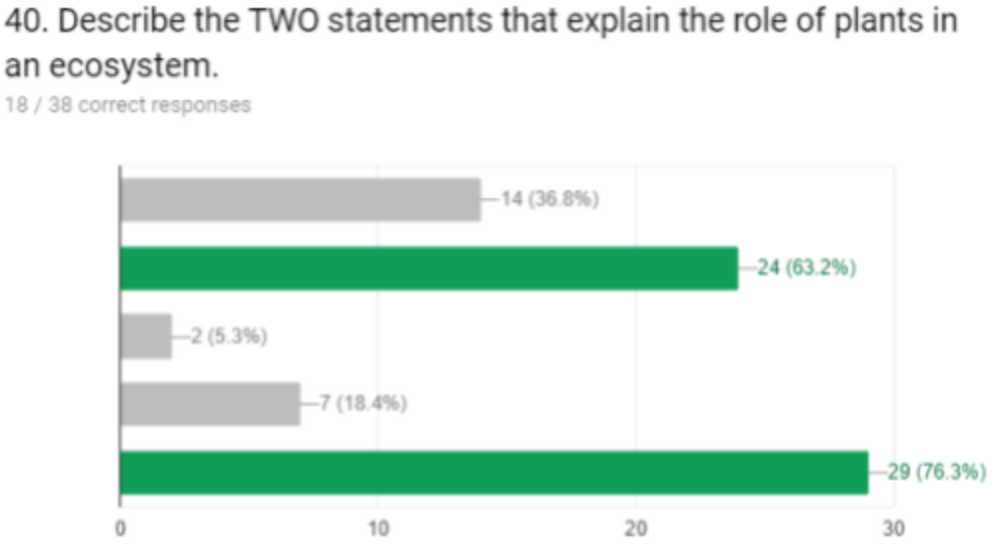

Figure 2

The above Figures 1 and 2 shows how students answered the question missed the most. This was not a topic addressed in the art integration portion of our final project and therefore, may have negatively skewed the results in some fashion. Overall, students who were in the experimental group did fairly well, with an average score of 35.34 out of 41 points or 86% correct. More than

half of students earned letter grades of A or B on their final test after completing their art integration project. Figure 3 below is the distribution of scores students earned on their tests after completing the art integration project.

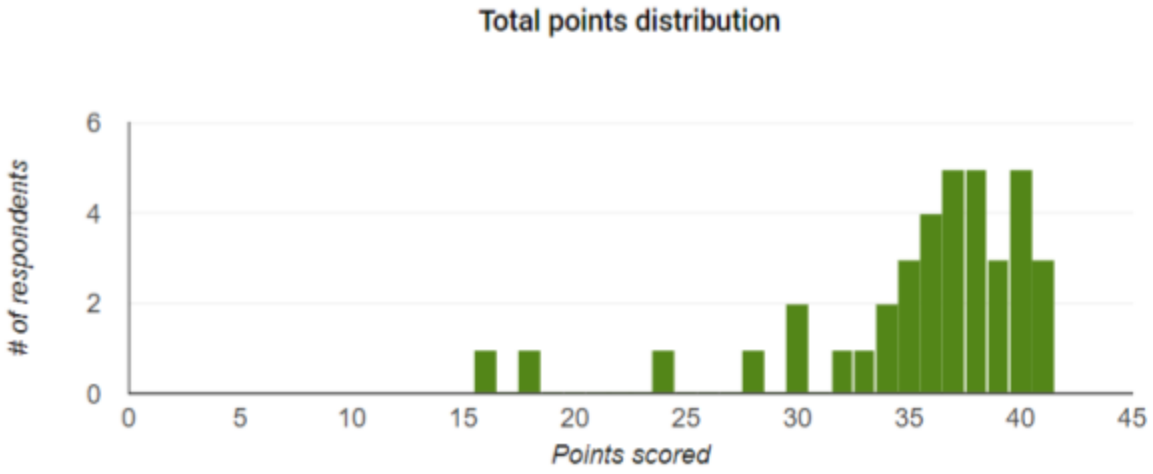

Figure 3

I did find additional questions pertaining directly to food chains and food webs had a high percentage of students answering the questions correctly. Examples of these include some of the following questions (see Figures 4 and 5):

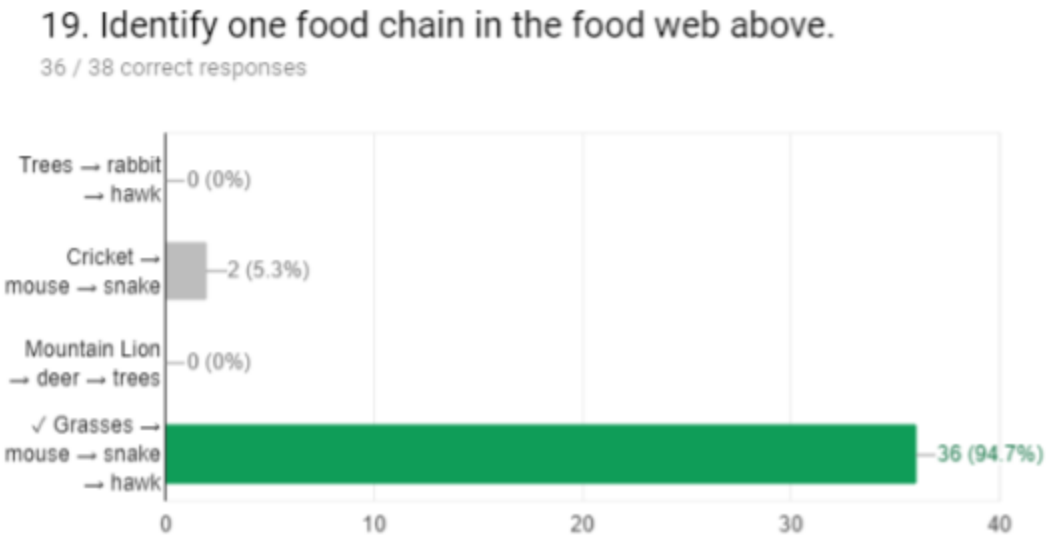

Figure 4

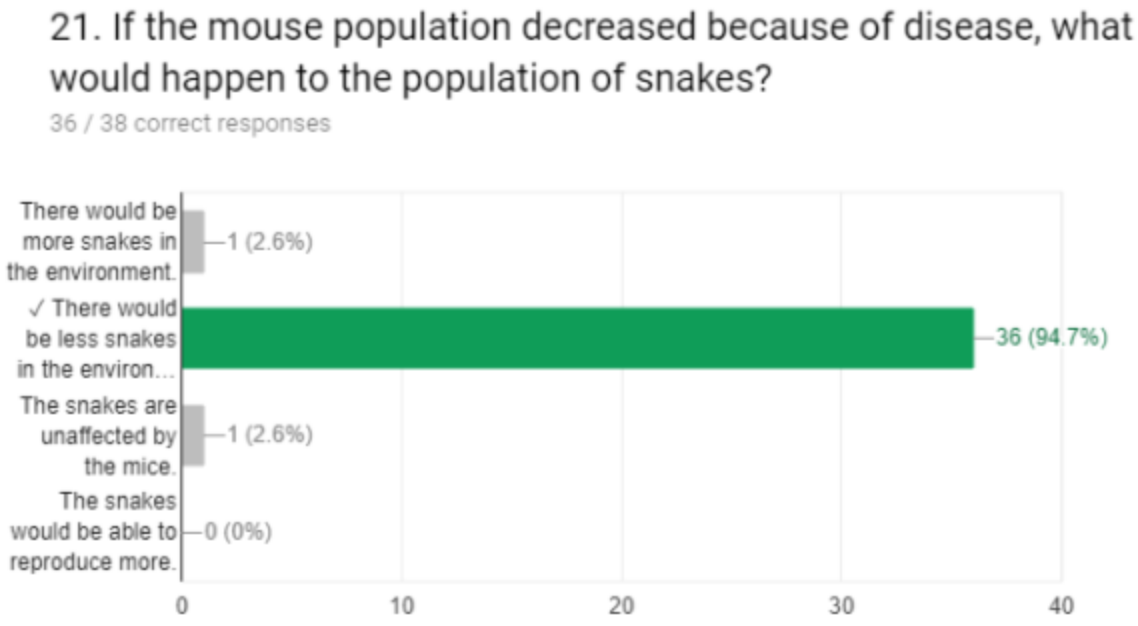

Figure 5

The above questions from Figures 4 and 5 were similar to questions students needed to address in the creative written component of the lesson and students had a plethora of practice with these kinds of questions from their creative writing pieces. Although the unfamiliar question (see Figure 6) was similar to those students answered previously in their creative writing, students had a more difficult time answering this question compared to question 21 shown in figure 5 above. However, 65.6% of students made the correct connections.

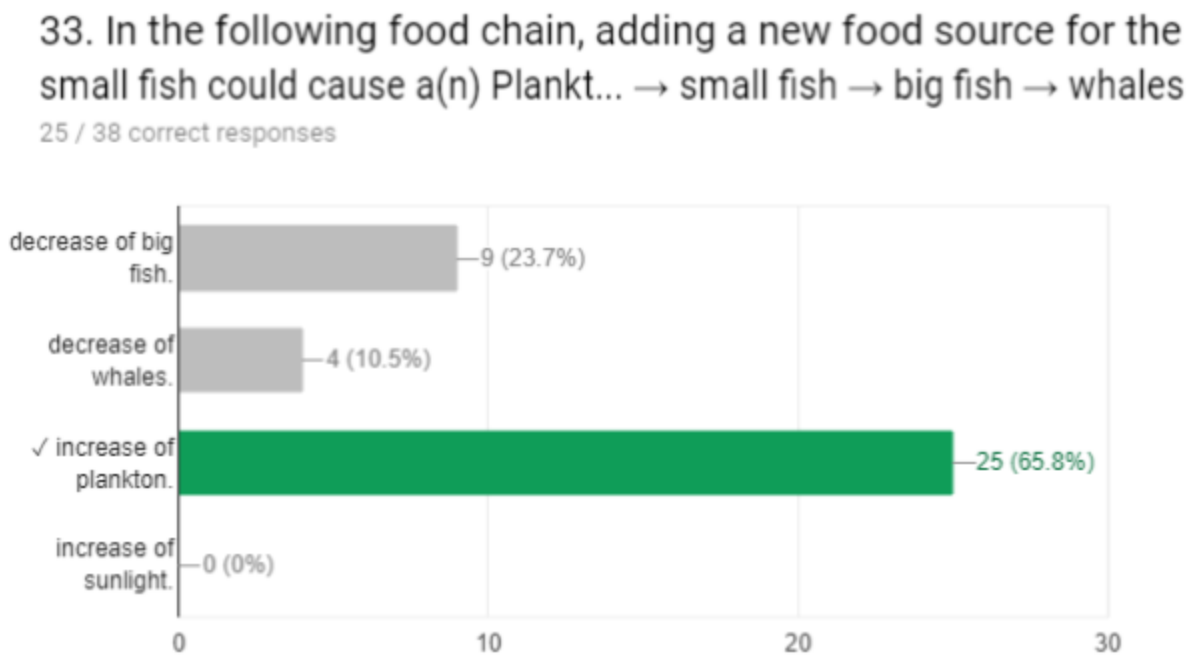

Figure 6

This tells me that although my students practiced manipulating food chains, they were not as adept at applying all of their knowledge to less familiar problems even after the art integration project.

Altogether, my students were able to perform well on their tests after completing the art integration project. Even though there were some harder questions on the test, students did very well, with an average score of 35.34 out of 41 points, or 86%. Compared to the control group class, those without the art integration, on average, my students earned an one extra point on their test, which is a total of 3% higher.

Conclusions and Implications

Some of the main messages emerging from my research was that my students did well overall on their test, but perhaps not substantially over the other class. Indicating art integration

project may not have produced a statistically significant impact on the learning of my students. I was surprised the final scores for both classes on the test between the experimental class and the control group were less noticeable than anticipated. Based on my initial research into the topic, the art integration should have had a considerable impact on the learning of my students. In my literature review, I quoted Vidcode, a video-based coding platform, as saying in an article written for *The Huffington Post*, that an art education allowed students to learn in a more open manner in order to make what they are learning relatable to real life. They pointed out art is used in a multitude of technology and other types of careers, the example given was of a computer science major using art to help design something in the program they are coding (The Importance of STEAM Learning). I do believe that the art integration project allowed my students to learn and apply their knowledge in a new way that will help with future purposes. Although these other implications were not measured by the evaluation students were given at the end of the unit. I believe the reason these results were not significant was because my students had not done a project like this before and would benefit from more exposure to this kind of project.

Through this research, I learned my students enjoyed working on projects involving art and the integration of other disciplines, such as writing and technology. I also learned this is a category of project I will want to recreate and continue to research within my own future classroom. From the results my research, I propose art integration has many benefits for students, both in the classroom and in future endeavors. I still believe art integration provides students with the aforementioned benefits, so I will continue to further my knowledge of the topic and, perhaps, refine and conduct further research in my own classroom.

The results of this research have expanded my interest in the topic. I would like to see if larger art integration projects, and maybe even a whole unit, will benefit my students knowledge of science content perhaps more significantly than a single unit of study. Additionally, I would like to see how working with other educators in a grade level compares to working alone in just the science classroom. For example, will students gain further understanding of different content, such as math , if art is used in those classes? Or if art is used throughout the year, would students benefit more from the art integration and depict statistically significant results in recollection of concepts?

Some limitations of my study were that I could not see the long-term knowledge retention my students had of ecosystems after my departure and the conclusion of the school year. This study was also limited as there were no replications of the initial experiment within the same group of students. This was the first time such a project like this had been conducted with these students, and I would have liked to see if the results would be different if it had been repeated in additional units of study. Although this research did not include a test of knowledge retention after so many months, I can attest, however, to my students recalling specific knowledge of our ecosystem unit three months later. I observed this when students were taking practice test reviews over ecosystems. Many of the students in my class did very well on these practice examinations and were able to access the material taught and covered during our art integration project. An ancillary limitation of this research is that it was only conducted with one group of 41 students, at one school, in a small town. Due to this limitation it is difficult to generalize the findings for all students at any school or in any broader context.

If I was able to continue this study in a different class with different students, I would require more art integration projects for analysis. In addition to this, I would also want to give students a post survey to understand they feel their learning was impacted by the art integration project and, perhaps, determine student satisfaction with the depth and ease of their knowledge. Along with additional projects, I would also want to complete more art integration lessons throughout several differing education units. I believe by using art continually throughout the learning process, students would be able to retain even more information. From the onset of a year of art integration in a science class, I would wish to introduce my students to different jobs utilizing both art and science together. This may provide my students with some rationale for why we are including art in our classroom and help them to visualize a bigger picture of life after school. By including this section before stating our art integration units and lessons, I would hope to open their eyes of my students so they can see art and science are all around them.

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